What is claimed is:

1. An adjustable mattress and pillow system comprising:

(a) a mattress which adapts to an optimum contour for support of a user's body, the mattress comprising a mattress top face and a mattress bottom face, the mattress top face being covered in part by an electrically conductive sensing mat having a mat top outer face for receiving and supporting a user's body and a mat bottom outer face in substantial contact with the mattress top face, the mat comprising an electrically conductive elastomeric membrane which exhibits a decreasing electrical resistance when compressed and which covers in part the mat top outer face;

(b) one or more inflatable mattress compartments located within the mattress, the compartments being positioned between the top face and bottom face of the mattress and connected to a fluid reservoir for receiving and discharging fluid;

(c) a pillow which is positioned on the top face of the mattress and which adapts to an optimum contour for support of a user's head and neck, the pillow comprising a top face for supporting a user's head and neck and a bottom face in contact with the mattress top face;

(d) one or more inflatable pillow compartments located within the pillow, the compartments being positioned between the top face and bottom face of the pillow and connected to a fluid reservoir for receiving and discharging fluid; and

(e) a pumping/control unit under microprocessor control and positioned remotely from the mattress and pillow, the microprocessor control being in electrical contact with the mat for receiving and processing electrical signals from the mat, the pumping/control unit being connected to a fluid reservoir and the inflatable mattress compartments and the inflatable pillow compartments for transmitting fluid from the reservoir to one or more of those compartments and for discharging fluid from one or more of those compartments to the reservoir, wherein

when the user reclines upon the mattress and pillow, the microprocessor control:

(1) receives electrical input signals from the electrically conductive sensing mat which vary in relationship to the width of compressed area and pressure exerted on the electrically conductive sensing mat as the position of the user shifts; (2) processes the

input signals pursuant to preprogrammed instructions; and (3) transmits an output signal to the pumping/control unit, and wherein depending upon the output signal, fluid is either transmitted from the reservoir by the pumping/control unit to one or more of the inflatable mattress compartments or inflatable pillow compartments, or is discharged from one or more of the inflatable mattress compartments or inflatable pillow compartments by the pumping/control unit to the reservoir to optimize the contours of the mattress and pillow relative to the position of the user on the mattress and pillow.

2. The system of claim 1, wherein the pumping/control unit is connected to the fluid reservoir and inflatable mattress compartments and inflatable pillow compartments by a plurality of conduits and the transmission of fluid from the reservoir to the compartments, and discharge of fluid from the compartments to the reservoir, is regulated by transmission of the output signal to both the pumping/control unit and conduit valves which open and close in response to the output signal.

3. The system of claim 2, wherein the conduits are flexible pipes or hoses, and wherein the mat comprises electrically conductive elastomers sandwiched in between the mat top inner face and the mat bottom inner face.

4. The system of claim 3, wherein the pumping/control unit is a pump.

5. The system of claim 1, wherein the electrically conductive sensing mat is affixed to the mattress top face.

6. The system of claim 1, wherein the fluid is a liquid.

7. The system of claim 1, wherein the fluid is a gas.

8. The system of claim 4, wherein the fluid is a liquid.

9. The system of claim 1, wherein the pillow is affixed to the mattress top face.

10. The system of claim 1, wherein the pillow comprises a cushioning material that envelops the inflatable pillow compartments.

11. The system of claim 1, wherein the mattress comprises a cushioning material that envelops the inflatable mattress compartments.

12. An adjustable mattress and pillow system comprising:

(a) a mattress which adapts to an optimum contour for support of a user's body, the mattress comprising a mattress top face and a mattress bottom face, the mattress top face being substantially covered by an electrically conductive sensing mat having a mat top outer face for receiving and supporting a user's body and a mat bottom outer face in substantial contact with the mattress top face, the electrically conductive sensing mat comprising an electrically conductive elastomeric membrane which exhibit a decreasing electrical resistance when compressed and which substantially covers the mat top outer face;

(b) one or more inflatable mattress compartments located within the mattress, the compartments being (1) positioned between the top face and bottom face of the mattress (2) connected to a fluid reservoir for receiving fluid, and (3) provided with at least one fluid vent under microprocessor control for discharge of fluid ;

(c) a pillow which is positioned on the top face of the mattress and which adapts to an optimum contour for support of a user's head and neck, the pillow comprising a top face for supporting a user's head and neck and a bottom face which is substantially in contact with the mat top face;

(d) one or more inflatable pillow compartments located within the pillow, the compartments being (1) positioned between the top face and bottom face of the pillow, (2) connected to a fluid reservoir for receiving fluid, and (3) provided with at least one fluid vent under microprocessor control for discharge of fluid; and

(e) a pumping/control unit under microprocessor control and positioned remotely from the mattress and pillow, the pumping/control unit being connected to a fluid reservoir and the inflatable mattress compartments and the inflatable pillow compartments for transmitting fluid from the reservoir to one or more of those compartments,

wherein the microprocessor control (1) is in electrical contact with the electrically conductive sensing mat for receiving and processing electrical signals from the mat which vary in relationship to the pressure exerted on the mat as the position of the user shifts, (2) processes those signals pursuant to preprogrammed instructions, and (3) transmits an output signal to the pumping/control unit and fluid vents, and wherein, on the basis of the output signal, fluid is either transmitted from the reservoir by the pumping/control unit to one or more of the inflatable mattress compartments or inflatable pillow compartments, or is discharged from one or more of the inflatable mattress compartments or inflatable pillow compartments by a fluid vent to optimize the contours of the mattress and pillow relative to the user's position on the mattress and pillow.

13. The system of claim 12, wherein the pumping/control unit is connected to the fluid reservoir and inflatable mattress compartments and inflatable pillow compartments by a plurality of intake conduits, and the transmission of fluid from the reservoir to the compartments and the discharge of fluid from the compartments through the vents, is regulated by transmission of the output signal to both the pumping/control unit and intake conduit valves and fluid vent valves which open and close in response to the output signal.

14. The system of claim 13, wherein the intake conduits and fluid vent are flexible pipes or hoses and wherein the electrically conductive sensing mat comprises electrically conductive elastomers sandwiched in between the electrically conductive sensing mat top inner face and the electrically conductive sensing mat bottom inner face.

15. The system of claim 14, wherein the pumping/control unit is a pump.

16. The system of claim 12, wherein the electrically conductive sensing mat is affixed to the mattress top face.

17. The system of claim 12, wherein the fluid is a liquid.

18. The system of claim 12, wherein the fluid is a gas.

19. The system of claim 14, wherein the fluid is a liquid or gas.

20. The system of claim 12, wherein the pillow is affixed to the mattress top face.

21. The system of claim 12, wherein the pillow comprises a cushioning material that envelops the inflatable pillow compartments.

22. The system of claim 1, wherein the mattress comprises a cushioning material that envelops the inflatable mattress compartments.

23. An apparatus for supporting a subject in a substantially prone position, comprising a mattress and pillow system of claims 1 or 12 supported by a frame, wherein the fluid reservoir, pumping/control units, and microprocessor control are also supported by the frame.

24. The apparatus of claim 23, wherein the apparatus is a bed, a stretcher, an examining table, or an operating table.

25. The systems of claims 1 or 12, wherein the pumping/control unit is under the control of a control device that incorporates the microprocessor and functions as a mass flow controller in which the microprocessor has sensing and signal processing elements in communication with valve drives that operate valves to control the mass flow rate of fluid to and from the mattress and pillow compartments.

26. The systems of claims 1 or 12, wherein the microprocessor is preprogrammed with a set point established by an external input supplied by the user or a third party in order to fix a desired fluid flow rate, and hence mattress and pillow contour, in response to certain signals transmitted from mat.

27. A method of supporting a body element comprising:

(a) providing an adjustable mattress and pillow system wherein a mattress adapts to an optimum contour for support of a user's body, the mattress comprising a mattress top face and a mattress bottom face, the mattress top face being covered in part by an electrically conductive sensing mat having a mat top outer face for receiving and supporting a user's body and a mat bottom outer face in substantial contact with the mattress top face, the electrically conductive sensing mat comprising an electrically conductive elastomeric membrane which exhibits a decreasing electrical resistance when compressed and which substantially covers the mat top outer face;

(b) providing one or more inflatable mattress compartments located within the mattress, the compartments being (1) positioned between the top face and bottom face of the mattress (2) connected to a fluid reservoir for receiving fluid, and (3) provided with at least one fluid vent under microprocessor control for discharge of fluid ;

(c) providing a pillow which is positioned on the top face of the mattress and which adapts to an optimum contour for support of a user's head and neck, the pillow comprising a top face for supporting a user's head and neck and a bottom face which is substantially in contact with the mat top face;

(d) providing one or more inflatable pillow compartments located within the pillow, the compartments being (1) positioned between the top face and bottom face of the pillow, (2) connected to a fluid reservoir for receiving fluid, and (3) provided with at least one fluid vent under microprocessor control for discharge of fluid; and

(e) providing a pumping/control unit under microprocessor control and positioned remotely from the mattress and pillow, the pumping/control unit being connected to a fluid reservoir and the inflatable mattress compartments and the inflatable pillow compartments for transmitting fluid from the reservoir to one or more of those compartments

wherein a user is positioned upon the mattress top face and pillow and the microprocessor control (1) is in electrical contact with the mat for receiving and processing electrical signals from the mat which vary in relationship to the pressure exerted on the mat as the position of the user shifts, (2) processes those signals pursuant to preprogrammed instructions and, (3) transmits an output signal to the pumping/control unit and fluid

vents, and wherein, on the basis of the output signal, fluid is either transmitted from the reservoir by the pumping/control unit to one or more of the inflatable mattress compartments or inflatable pillow compartments, or is discharged from one or more of the inflatable mattress compartments or inflatable pillow compartments by a fluid vent to optimize the contours of the mattress and pillow relative to the user's position on the mattress and pillow.

28. The method of claim 27, wherein the pumping/control unit is connected to the fluid reservoir and inflatable mattress compartments and inflatable pillow compartments by a plurality of intake conduits, and the transmission of fluid from the reservoir to the compartments and the discharge of fluid from the compartments through the vents, is regulated by transmission of the output signal to both the pumping/control unit and intake conduit valves and fluid vent valves which open and close in response to the output signal.

29. The method of claim 28, wherein the intake conduits and fluid vent are flexible pipes or hoses, and wherein the mat comprises electrically conductive elastomers sandwiched in between the mat top inner face and the mat bottom inner face.

30. The method of claim 27, wherein the pumping/control unit is a pump.

31. The method of claim 27, wherein the electrically conductive sensing mat is affixed to the mattress top face.

32. The method of claim 27, wherein the fluid is a liquid or gas.

33. The method of claim 27, wherein the pillow is affixed to the mattress top face.

34. The method of claim 27, wherein the pillow comprises a cushioning material that envelops the inflatable pillow compartments.

35. The method of claim 27, wherein the mattress comprises a cushioning material that envelops the inflatable mattress compartments.

36. The method of claim 27, wherein the pumping/control unit is under the control of a control device that incorporates the microprocessor and functions as a mass flow controller in which the microprocessor has sensing and signal processing elements in communication with valve drives that operate valves to control the mass flow rate of fluid to and from the mattress and pillow compartments.

37. The method of claim 27, wherein the microprocessor is preprogrammed with a set point established by an external input supplied by the user or a third party in order to fix a desired fluid flow rate, and hence mattress and pillow contour, in response to certain signals transmitted from mat.

38. An adjustable mattress and pillow system comprising:

(a) a mattress which adapts to an optimum contour for support of a user's body, the mattress comprising a mattress top face and a mattress bottom face, the mattress top face being covered in part by a sensing mat having a mat top outer face for receiving and supporting a user's body and a mat bottom outer face in substantial contact with the mattress top face, the mat comprising an elastomeric sensing membrane which covers in part the mat top outer face and which, when compressed, transmits a sensing signal;
(b) one or more inflatable mattress compartments located within the mattress, the compartments being positioned between the top face and bottom face of the mattress and connected to a fluid reservoir for receiving or discharging fluid;
(c) a pillow which is positioned on the top face of the mattress and which adapts to an optimum contour for support of a user's head and neck, the pillow comprising a top face for supporting a user's head and neck and a bottom face which is substantially in contact with the mattress top face;
(d) one or more inflatable pillow compartments located within the pillow, the compartments being positioned between the top face and bottom face of the pillow and connected to a fluid reservoir for receiving or discharging fluid;
(e) a pumping/control unit under microprocessor control and positioned remotely from the mattress and pillow, the microprocessor control being in electrical contact with the mat for receiving and processing sensing signals from the mat into electrical signals, the pumping/control unit being connected to a fluid reservoir and the inflatable mattress compartments and the inflatable pillow compartments for transmitting fluid from the reservoir to one or more of those compartments and for discharging fluid from one or more of those compartments to the reservoir,
wherein, when the user reclines upon the mattress and pillow, the microprocessor control (1) receives and processes into electrical signals input sensing signals from the sensing mat which vary in relationship to the pressure exerted on the sensing mat as the position of the user shifts, (2) processes those signals pursuant to preprogrammed instructions and, (3) and transmits an output signal to the pumping/control unit, and wherein on the basis of the output signal, fluid is either transmitted from the reservoir by the pumping/control unit to one or more of the inflatable mattress compartments or inflatable pillow

compartments, or is discharged from one or more of the inflatable mattress compartments or inflatable pillow compartments by the pumping/control unit to the reservoir to optimize the contours of the mattress and pillow relative to the user's position on the mattress and pillow.

39. The system of claim 38, wherein the sensing mat utilizes either an infrared sensor, an ultrasonic detector, a digital image scanner, an electrically conductive elastomeric membrane, or electrically conductive silicon rubber to transmit input sensing signals from the sensing mat to the microprocessor control.

40. The system of claim 38, wherein the mat comprises an induction system combined with a piece of metal foil situated under the user, and wherein displacement of the metal foil modifies a self-induction coefficient of an induction coil, thereby shifting the resonant frequency of an LC circuit away from the tuning frequency of an oscillator and damping the signal delivered to an amplifier by the oscillator to ensure that the signal is correctly processed and appropriately monitored.

41. The system of claim 38, wherein the mat comprises a capacitive array which is interconnected with the pumping/control unit under microprocessor control, and wherein the a pumping/control unit under microprocessor control supplies to the capacitive array a suitable oscillator derived driver current and concurrently senses capacitance value changes within the capacitive array induced through dielectric shifts within the array brought about by the proximity or absence thereof of the user's body mass.

42. The system of claim 38, wherein the pumping/control unit under microprocessor control comprises a power supply, a driver/sensor circuit, a comparator/calibration logic circuit, a system interconnection integrity circuit and an alarm generation circuit.

43. The system of claim 42, wherein the pumping/control unit under microprocessor control comprises a nurse call relay circuit for interconnection to a facilities nurse call system.

44. The system of claim 42, wherein the system further comprises a proximity induced non-compressive dielectric shift sensing mechanism.